Computer Graphics
– Transformations (Questions)

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Possible Questions

Given is a point q on the plane and a normalized normal n_0

Task: project p orthogonally on the plane

$$q = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix},\ n_0 = \begin{pmatrix} 1/3 \\ 2/3 \\ 2/3 \end{pmatrix}$$

$$p = \begin{pmatrix} 4 \\ 5 \\ 9 \end{pmatrix}$$

$$\boxed{p - n_0 \cdot \langle n_0, v \rangle}$$

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$$\begin{aligned} OP_p &= p - n_0 \cdot \langle n_0, p - q \rangle \\ &= p - n_0 \cdot (1 + 2 + 4) \\ &= \begin{pmatrix} 4 \\ 5 \\ 9 \end{pmatrix} - \begin{pmatrix} 7/3 \\ 14/3 \\ 14/3 \end{pmatrix} \\ &= \frac{1}{3} \begin{pmatrix} 5 \\ 1 \\ 13 \end{pmatrix} \end{aligned}$$

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Construct a transformation matrix that scales with $S = (2,3,2)$ and translates along $T = (0, -7, -2)$

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$$\begin{pmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & -7 \\ 0 & 0 & 2 & -2 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Possible Questions

How is the 2D rotation matrix defined?

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$$\begin{pmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{pmatrix}$$

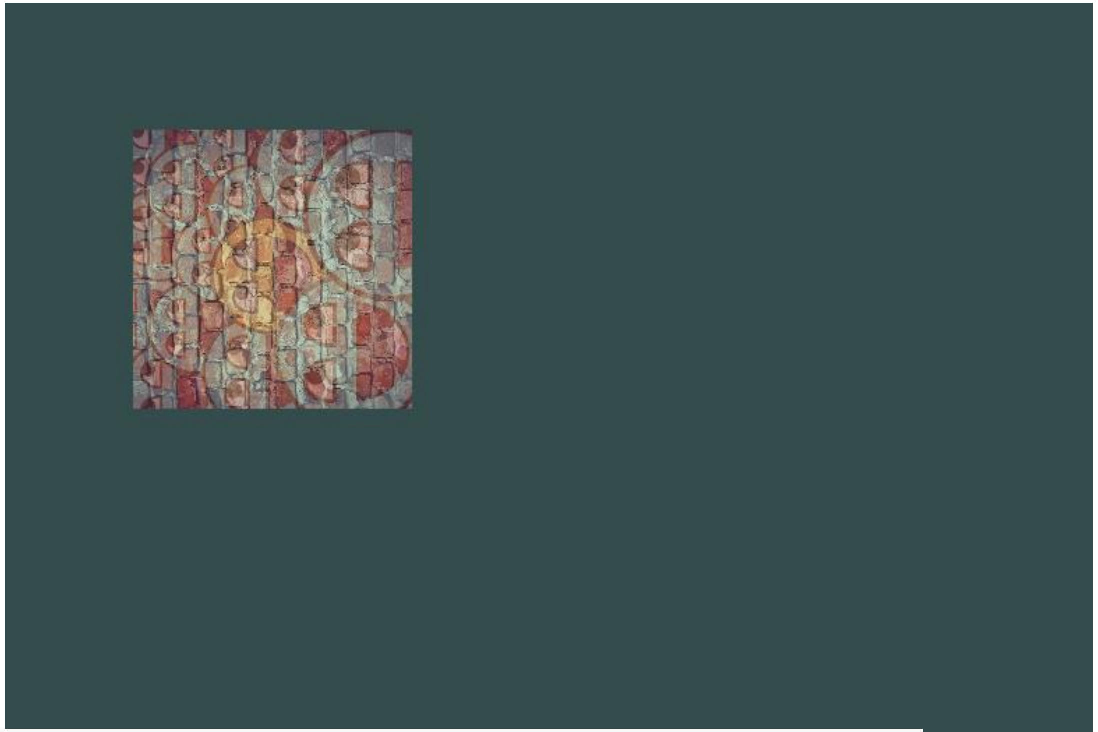
Possible Questions

Fill in the correct argument

```
glm::mat4 trans = glm::mat4(1.0);
trans = glm::rotate(trans,                    , glm::vec3(0.0, 0.0, 1.0));
trans = glm::scale(     , glm::vec3(0.5, 0.5, 0.5));
trans = glm::translate(trans, glm::vec3(1.0f, 1.0f, 0.0f));
```

Possible Questions

Fill in the correct argument



```
glm::mat4 trans = glm::mat4(1.0);
trans = glm::rotate(trans, glm::radians(90.0f), glm::vec3(0.0, 0.0, 1.0));
trans = glm::scale(trans, glm::vec3(0.5, 0.5, 0.5));
trans = glm::translate(trans, glm::vec3(1.0f, 1.0f, 0.0f));
```

Possible Questions

Simplify:

$$(2 + 3i) \cdot (1 - i)$$

Possible Questions

Simplify:

$$\begin{aligned}(2+3i)\cdot(1-i) &= 2-2i+3i-3i^2 \\ &= 5+i\end{aligned}$$

Possible Questions

Complete the table

x	1	i	j	k
1				
i				
j				
k				

b

a

ab

Possible Questions

Complete the table

x	1	i	j	k
1	1	i	j	k
i	i	-1	k	-j
j	j	-k	-1	i
k	k	j	-i	-1

b

ab

a

Possible Questions

Assume, we have a point p and we want to ccw rotate them around an axis q with $||q|| = 1$ about the angle α

How can we achieve this with quaternions?

Possible Questions

Set:

$$p = p_x i + p_y j + p_z k$$

$$q = q_x i + q_y j + q_z k$$

Assign:

$$q \leftarrow \cos(\alpha/2) + \sin(\alpha/2) \cdot q$$

Then, determine:

$$rot = q \cdot p \cdot q^*$$